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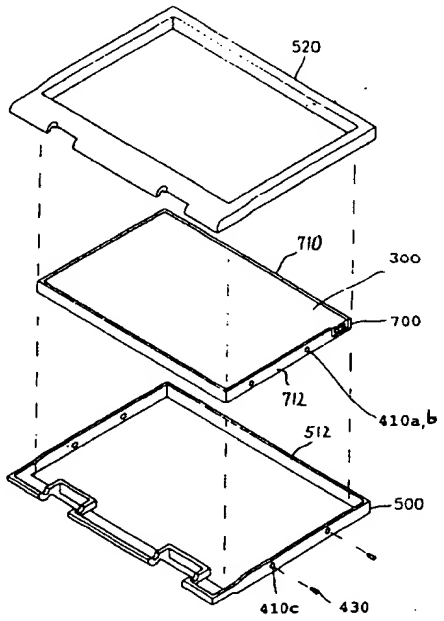
(54) LCD device, LCD board and display or computer comprising a LCD device

(57) A LCD device (700, 500) includes a LC panel (300) having a display area, a light source joined with the LC panel, a mounting frame (710) frame coupled to a surface of the light unit and sides of the LC panel, an casing frame (500), and a fastening element (430) joining together the mounting frame and the outer casing frame through the sides of the mounting frame and the outer casing frame.

FIG.7



EP 0 880 049 A1

Description

The invention relates to a liquid crystal display (LCD) device, a LCD board, a LCD indication device and a computer, espicially a portable computer comprising the LCD device.

In general, a liquid crystal display (LCD) device used for a computer such as a portable computer or for a portable display is shown in Fig. 1. Referring to Fig. 1, the LCD device includes a liquid crystal panel 20, a back light unit, and a driving circuit board 23. The back light unit is comprised of a luminescent lamp 11, a lamp housing 12 having a U-shape and surrounding the lamp 11, a light guide 13, a reflector 14 reflecting the incident light from the horizontal direction to the vertical direction, a protection sheet 15 contacting the light guide 13, a first prism sheet 16 and a second prism sheet 17 set on the protecting sheet 15 and condensing the incident light from the light guide 13 to some direction, a diffuser 18 diffusing the light from the first and second prisms 16 and 17 to a viewing area 21 of the liquid crystal panel 20 with a certain viewing angle, and a first support frame 19 supporting these elements.

Fig. 3 shows a cross-sectional view of the light-guiding plate 13 showing a gradual thickness decrease in cross-section as it extends away from the light source 11. A fluorescent lamp 11 as the light source is fixed at a thicker end of the light-guiding plate 13. When the fluorescent lamp 11 is turned on, the light 23 from the source 11 is reflected by the lamp housing 12 surrounding the fluorescent lamp 11. The reflected light transmits through the cross-section towards the other side (thinner end) of the light-guiding plate 13 as indicated by the arrows. Then, the light spreads all over the surface of the light-guiding plate 13 and reaches the display area 21 (Fig. 1) through the diffusion plate 18. At the same time, a thin film transistor formed on the liquid crystal panel controls a corresponding pixel according to the signals from the driving circuit 30 (Fig. 1) to selectively transmit the light which collectively realizes the display of images on the display area.

The liquid crystal display is usually combined with, for example, a notebook computer as an output screen. The following method is used to fix the liquid crystal display to a device such as a notebook computer.

Referring to Figs. 3a and 3b, in a conventional liquid crystal display, a ground supporting plate 30 is disposed on the first fastening frame 19. A mounting hole 33 is formed through the ground supporting plate 30 and the first fastening frame 19, as shown in Fig. 3b. Then, the ground supporting plate 30 and the first fastening frame 19 are fixed by a screw 31 as shown in Fig. 3a. In other words, a liquid crystal display is fixed to a device such as a notebook computer so as to fasten the first fastening frame 19 and the ground supporting plate 30 by a fastening element such as a screw.

However, the liquid crystal display becomes thicker due to the length of the screw according to the method as shown in Figs. 3a and 3b. Moreover, since the mounting hole 33 for the screw is formed on the front surface of the liquid crystal display, the display area of the liquid crystal display becomes narrow.

According to the structure described above, the LCD device operates as follows. The light from the luminescent lamp 11 is incident on the rear surface of the liquid crystal panel 20 through the back light unit. A control circuit place on the driving circuit board 30 controls the incident light on the viewing area 21 of the liquid crystal panel 20 to display images and characters.

Fig. 4 is a drawing showing a plan view of the final assembly structure of the conventional liquid crystal display device. Fig. 4 also shows the assembled result of a second support frame 40, liquid crystal panel 20 and back light unit having an assembly structure for mounting to a portable computer. The second support frame 40 is made of metal or plastic, and holds the liquid crystal panel 20 and the back light unit. Here, the driving circuit board 23 is located behind the rear part of the back light unit connected to the liquid crystal panel 20 with a flexible film (not shown).

Fig. 5 shows the assembly structure of the liquid crystal panel 20 and body 60 of the portable computer in the conventional method. The second support frame 40 is mounted to a rear case 50 of the portable computer using screws 43 through screw holes 41. A front case (not shown) having a blank area adjusted to the viewing area is joined at the rear case 50. That is, the liquid crystal panel 20 is mounted with the rear case 50 by the screws 43 locked in the normal direction of the display surface through the screw holes 41 formed on that surface. Although not shown in the drawings, the front case is mounted on the LCD device, opening the viewing area 21 and covering the other parts.

In general, as the size of the portable computer is designed for easy movement, the same goes for an A4 copy sheet, for example. Therefore, the ratio of the viewing area to the whole surface area of the display and the thickness of the display device affect the quality of the portable computer. However, in a conventional portable computer, screw holes 41 are located on edge portions of the display surface in order to join the second support frame 40 to the rear case 50. As the display area has a screw frame area 42 (Fig. 4) for forming the holes 41, the ratio of the area of the LC panel to the viewing area 21 is reduced.

Furthermore, in the conventional portable computer, as the screws 43 are locked to the liquid crystal display device and the rear case 50 in the normal direction of the display surface, the display part is thick enough to form an assembly device 51 for the screws 43, such as screw holes 41. The second support frame 40 is also large enough to have a space for supporting the screw holes 41. Thus, it is difficult to reduce the weight of the portable computer.

Accordingly, a liquid crystal device is needed having a high viewing ratio of the display, low weight, and

reduced thickness for a computer, such as a portable computer.

The present invention is directed to a LCD device, a LCD board and a display or computer comprising a LCD device that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to increase the ratio of the viewing area of the display to nearly the whole area of a mounting frame of the LCD board.

Another object of the present invention is to provide a thin, light weight display unit.

The invention is especially described in the claims.

The features and advantages of the invention will be set forth in the written description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a LCD device especially comprises a liquid crystal (LC) panel including a display area; a light source optically joined with the LC panel; a first support frame coupled to a surface of the light unit and sides of the LC panel; a second frame coupled to edges of the LC panel and sides of the first support frame; an outer casing; and a fastening part joining together the first support frame, the second support frame, and the outer casing through the sides of the first support frame, the second support frame, and the outer casing.

In another aspect of the present invention, a portable computer especially comprises a LCD device having a display surface and a first plurality of side surfaces; a body having an input device; a cover, coupled to an edge of the body, having a second plurality of side surfaces; and a fastening unit attaching the first plurality of side surfaces of the LCD device to the second plurality of side surfaces of the cover, the LCD device being mounted to the cover.

In another aspect of the present invention, a portable computer comprises a LCD device especially having a first side surface; a body having an input device; a cover joined with the body and having a second side surface; and a fastening unit joining together the LCD device and the cover through the first and second side surfaces of the LCD device and the cover, respectively.

In a further aspect of the present invention a LCD device comprises a first support frame having a first fastening member at a side surface of the first support frame; a reflector unit adjacent the first support frame; a light source adjacent to the reflector unit; a light guide unit adjacent the reflector unit; a protection unit adjacent the light guide unit; a prism unit adjacent the protection unit; a diffuser unit adjacent the prism unit; a LC panel adjacent the diffuser unit; and a second support frame having a second fastening member at a side surface of the second support frame, wherein the reflector unit, the protection unit, the prism unit, and the diffuser unit, the LC panel are between the first and second support frame, and the first and second support frame are attached to each other through the first and second fastening members through the side surfaces of the first and second support frames.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a perspective drawing showing the structure of the conventional LCD device;

Fig. 2 is a cross-sectional view of a light-guiding plate and a fluorescent lamp;

Fig. 3a is a plan view of a LCD showing a screw frame of a first fastening frame;

Fig. 3b is a cross-sectional view of a LCD illustrating a first fastening frame, a lamp housing, and ground support plates fixed together by a screw;

Fig. 4 shows a plan view of the final assembly structure of the LC panel, support frame, and back light unit in the conventional LCD device;

Fig. 5 shows an assembly structure of the LCD device in the conventional portable computer;

Fig. 6 is a perspective view showing the assembly structure of the parts of the LC board in accordance with one embodiment of the present invention;

Fig. 7 is a perspective view the assembly structure of a LCD board, a rear cover or casing frame, and a front cover in accordance with the present invention;

Fig. 8a and 8b are cross-sectional side views of a LCD board according to the present invention illustrating mounting holes at a side walls of the mounting frame, Fig. 8c showing a sectional part view along the section line in Fig. 8b; and

Fig. 9 shows an assembly structure of an LCD device and portable computer in accordance with the present invention.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

The present invention provides mounting holes for fastening pins on a side wall of a LCD board instead of on a front surface of a LCD board. For example, Fig. 8a and 8b show first mounting holes 410a formed on oppo-

site side walls of a mounting frame 710. With reference to Fig. 6, the structure of a LCD board according to the present invention will be described in detail.

Referring to Fig. 6, on an inner support frame 190 made of plastic, for example, a reflector 140, a light guide 130, a protection sheet 150, a first prism sheet 160, a second prism sheet 170, a diffuser 180, and a LC panel 300 are stacked sequentially. The inner support frame has a bottom wall 192 and four side walls 191 extending at right angles from the bottom wall. On opposite side walls 191 of the inner support frame 190, a plurality of lateral first screw holes 410a are formed.

At the edge of the light guide 130, a luminescent lamp 110 and a lamp housing 120 are mounted. The lamp housing 120 has an U-shape and surrounds the luminescent lamp 110 at three sides adjacent to the respective side wall 191 of the inner support frame.

In order to join the inner support frame 190, the LC panel 300, the illuminating assembly 130-180 and the lamp housing 120, a outer support frame 400 preferably made of metal is mounted at the side wall of the inner support frame 190. When mounted, the outer support frame 400 and the inner support frame overlap eachother at their side walls 401, 191. At the side wall 401 of the outer support frame 400, a plurality of second through holes 410b aligned with the first screw holes 410a as shown in Fig. 8a are formed.

Referring to Figs. 8a and 8b, the outer frame 400 and the inner frame 190 may be mounted together by a plurality of tongues 402 bent into respective depressions in the side wall of the inner frame 190. According to Figs. 8b and 8c, the side wall of the inner frame 190 is formed with a plurality of lugs 410e in which the screw holes 410a are formed and which extend through respective cutouts 410 of the side wall 401 of the outer frame 401.

Referring to Fig. 7, a LCD board 700 comprising the mounting frame 700 e.g. of the inner support frame 190 and the outer support frame 400 accomodating the LC panel 300 and the illuminating assembly (not shown in Fig. 7) is joined with a casing frame 500 at its side wall 712 and a front frame 520, the LCD board 700 and the casing frame 500 defining a LCD device according to the invention. At the side wall of the casing frame 500, third through holes 410c aligned with the first screw holes and second through holes 410a,b are formed. The casing frame 500 and the LCD board 700 are joined to each other by fastening devices such as clamping pins or screws 430, which extend through and may be locked to the second and third through holes 410b and 410c. Although not shown in the drawings, the screws 430 are locked with the first screw holes 410a.

In another embodiment, in order to join the outer support frame 400 and the casing frame 500, an adhesive device such as double-sided adhesive tape can be used instead of the second and the third screw holes 410b and 410c. This example has an added advantage in that no screws or clamping pins are needed which makes the manufacturing method easy.

In a further embodiment, the casing frame 500 and the outer support frame 400 are joined to each other using hooks and/or other suitable fastening devices including adhesives formed at inner sides of the casing frame 500. This embodiment also does not need fastening devices such as screws 430.

Accordingly, in the present invention, the assembling or fastening devices are engaging the side walls of the display and are not at the front or back side. The assembling devices are preferably screws, hooks or, adhesive materials, for example. The direction of the assembling devices is normal to the side wall of the display, that is, parallel direction with the front (viewing) outer surface of the display. Moreover, the assembling devices may be formed on the upper and lower sides of the display.

Referring to Fig. 9, the LCD board is mounted to a portable computer. One of the advantages of the portable computer or note book according to the present invention over the conventional portable computer is the higher ratio of the viewing area. Because there are no fastening elements on the display surface, the outer frame of the display area of the present invention is narrower than that of conventional ones. Thus, the ratio of the viewing area can be maximized and the thickness of the display part is made thinner than that of conventional ones.

Furthermore, as the volume of the frames of the present invention is smaller than that of conventional ones, the portable computer of the present invention is lighter. Additionally, as it is not necessary to have screws, the cost for manufacturing can be reduced.

It will be apparent to those skilled in the art that various modifications and variations can be made in the computer having a LCD device of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. LCD device comprising a LCD board (700) including a LC panel (300), an illuminating assembly (130-180) with a light source (110, 120), and a mounting frame (710) accomodating the LC panel and the illuminating assembly and extending along the edges (401) of the outer surface of the board (700) and the side walls thereof, and a casing frame (500) in which the LCD board (700) is mounted by its mounting frame (710) by means of fastening elements engaging the mounting frame at at least one of the side walls of the board in a direction in parallel with the plane of the outer surface of the board.

2. LCD device according to claim 1, the mounting

frame (710) including at said at least one side wall (712) a plurality of lateral mounting holes (410a) into which the fastening elements in the form of a plurality of pins (430) are engaged, each of the mounting holes and the pins extending in a plane in parallel with the plane of the outer surface of the board, each of the pins extending through one of adjoining through holes (410c) in respective side walls (512) of the casing frame (500).

3. LCD device according to claim 2, the mounting frame (710) comprising an outer support frame (400) and an inner support frame (190) being attached to each other at their side walls (401, 191), the side walls of the outer support frame overlapping the side walls of the inner support frame, at least one of the side walls of the inner support frame being formed with said mounting holes (410a) being aligned with respective openings (410b, 410d) in the adjoining side wall of the outer support frame.

4. LCD device according to claim 3, the inner support frame (190) including at its at least one side wall (191) a plurality of lugs (410e) formed with the mounting holes (410a), the respective openings (410d) in the adjoining side wall (401) of the outer support frame (400) being formed as a plurality of cutouts each of which receiving one of the lugs. cutouts each of which receiving one of the lugs.

5. LCD device according to one of claims 2 to 4, the pins being screwed pins or screws (430) and the mounting holes in the mounting frame being screw holes (410a).

6. LCD device according to one of claims 3 to 5, the illuminating assembly comprising:

a reflector unit (140) adjacent to the inner support frame (190);
a light source (110, 120) adjacent to the reflector unit;
a light guide unit (130) adjacent to the reflector unit;
a protection unit (150) adjacent to the light guide unit;
a prism unit (160, 170) adjacent to the protection unit;
a diffuser unit (180) adjacent to the prism unit;

the LC panel (300) being placed adjacent to the diffuser unit and between the diffusor unit and the outer support frame (190).

7. LCD device according to claim 1 the fastening elements being formed as double sided adhesive strips between and engaging the mounting frame (710) and the casing frame (500).

8. LCD board (700) comprising a LC panel (300), an illuminating assembly (130-180) with a light source (110, 120), and a mounting frame (710) accomodating the LC panel and the illuminating assembly and extending along the edges (401) of the outer surface of the board (700) and the side walls thereof, and including lateral mounting holes (410a) formed in at least one of the side walls (712) of the mounting frame for receiving fastening pins (430) extending in parallel with the outer surface of the board.

9. LCD board (700) according to claim 8, the mounting frame (710) comprising an inner support frame (190) and an outer support frame (400) between which the LC panel (300) and the illuminating assembly (130-180) with the light source (110, 120) are arranged and which include overlapping side walls (191, 401) at which the outer support frame (400) and the inner support frame (190) are attached to each other, the mounting holes (410a) being formed in at least one of the side walls of the inner support frame.

10. LCD board according to claim 9, the illuminating assembly comprising:

a reflector unit (140) adjacent to the inner support frame (190);
the light source (110, 120) adjacent to the reflector unit;
a light guide unit (130) adjacent to the reflector unit;
a protection unit (150) adjacent to the light guide unit;
a prism unit (160, 170) adjacent to the protection unit;
a diffuser unit (180) adjacent to the prism unit;

the LC panel (300) being placed adjacent to the diffuser unit and between the diffusor unit and the outer support frame (400).

11. Portable display device comprising a LCD device (700, 500) according one of claims 1 to 7.

12. Computer comprising a LCD device (700, 500) according to one of claims 1 to 7.

13. Computer according to claim 12 in the form of a portable computer comprising a main body (600) with an input device a hinged cover joined with the main body which includes the casing frame in which the LCD board is laterally fastened at opposite side walls of the LCD board.

FIG. 1

PRIOR ART

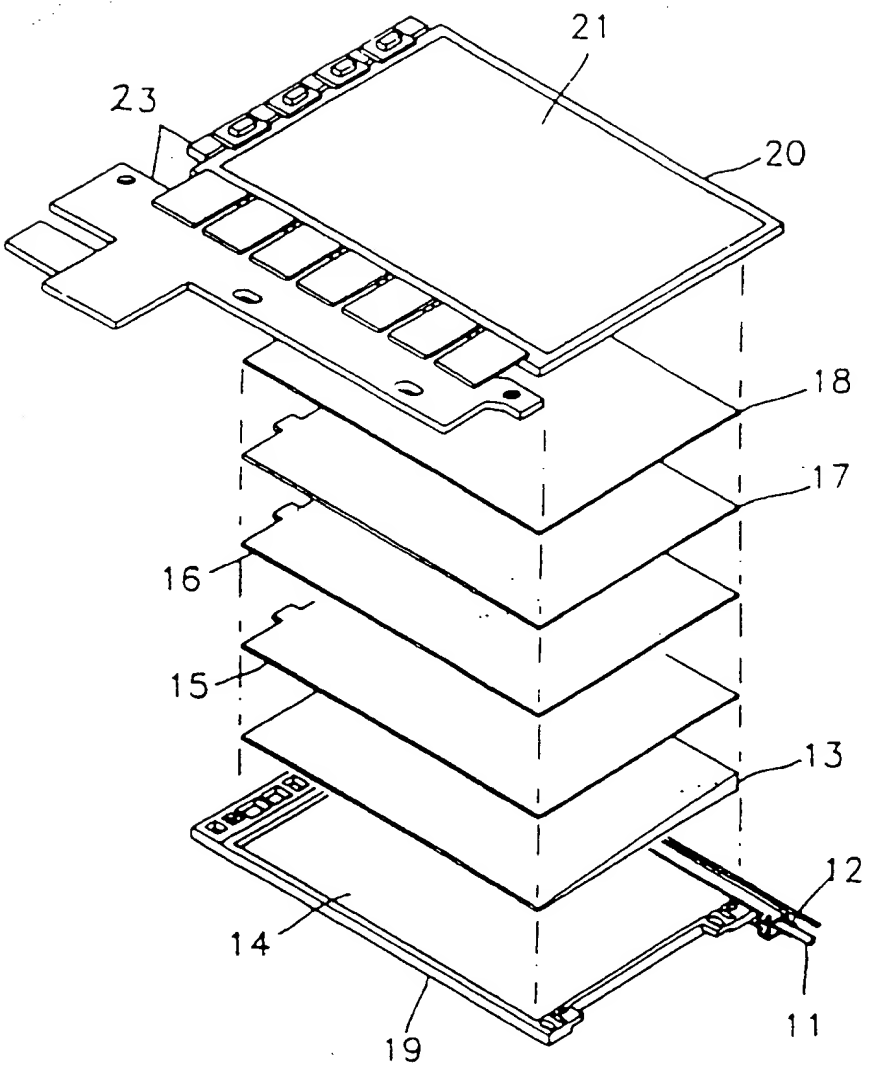


FIG. 2

PRIOR ART

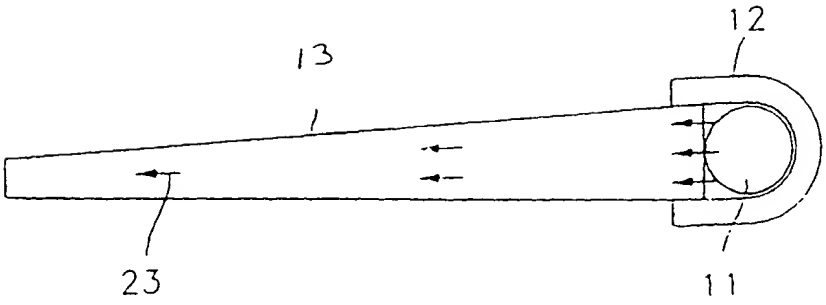


FIG. 3a

PRIOR ART

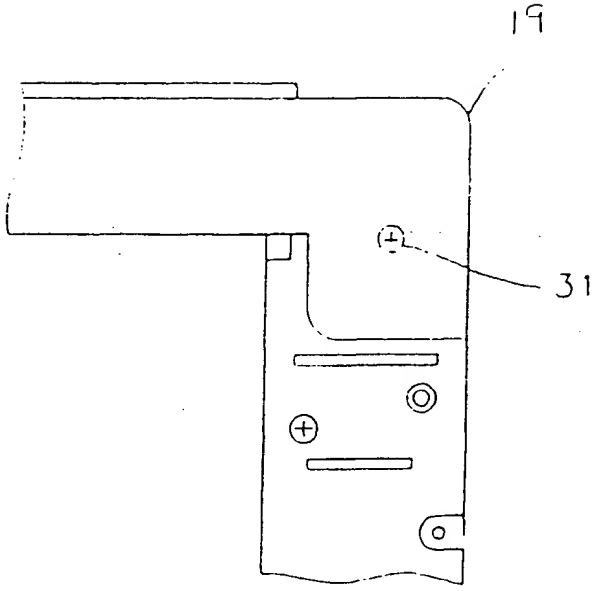


FIG. 3b

PRIOR ART

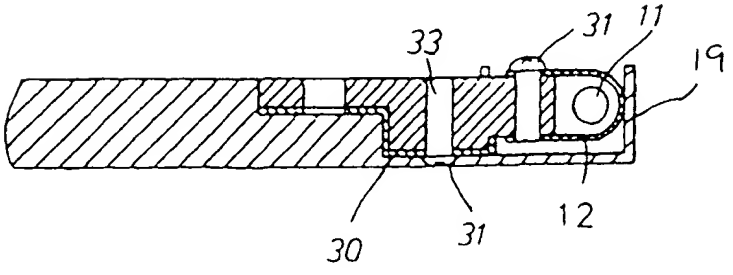


FIG. 4

PRIOR ART

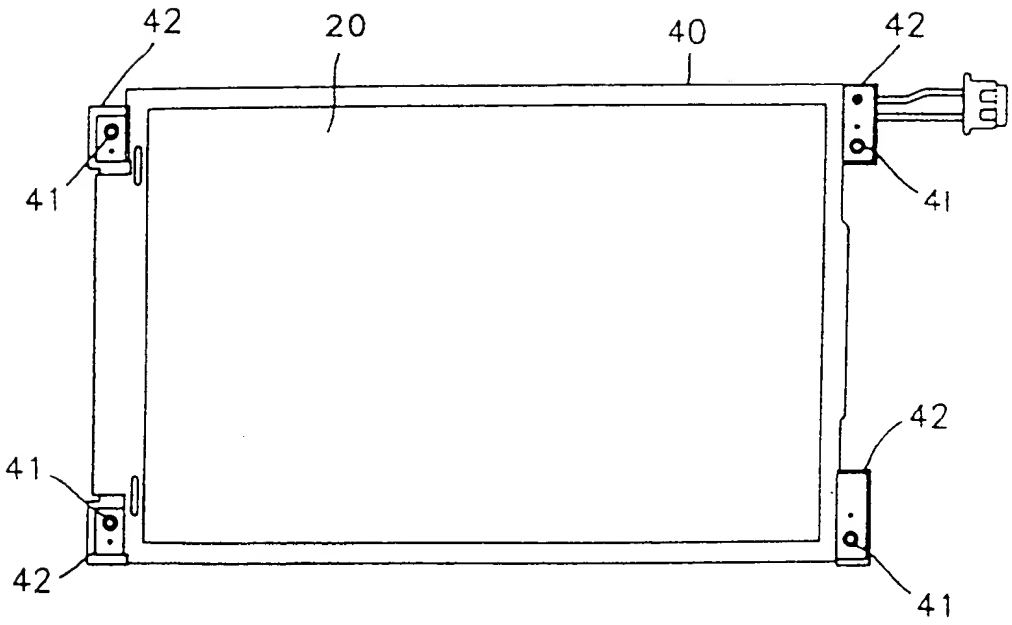


FIG. 5

PRIOR ART

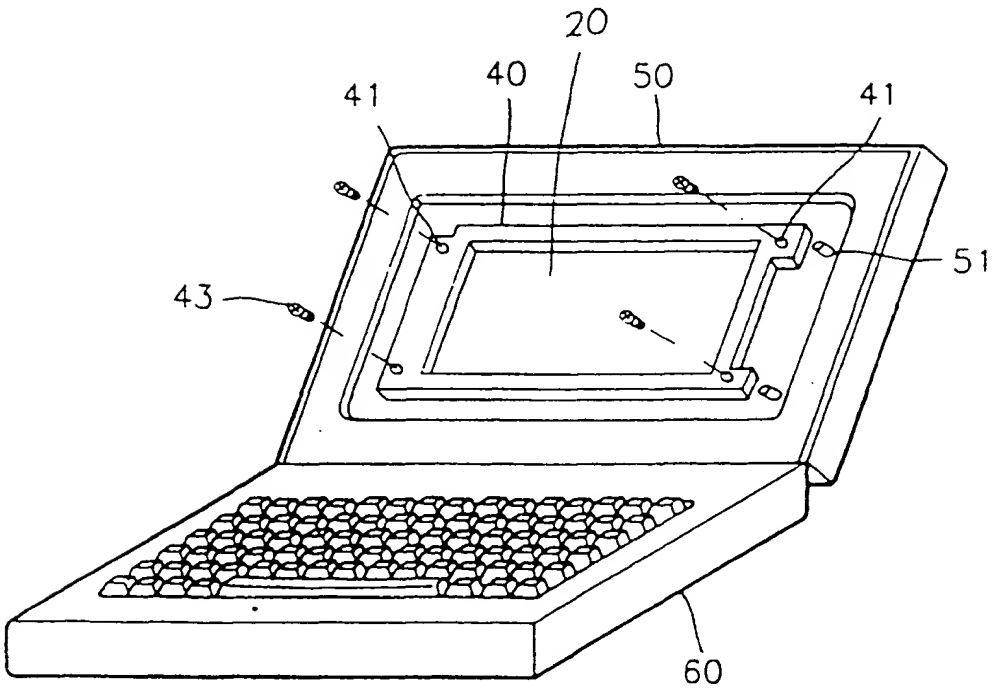


FIG.6

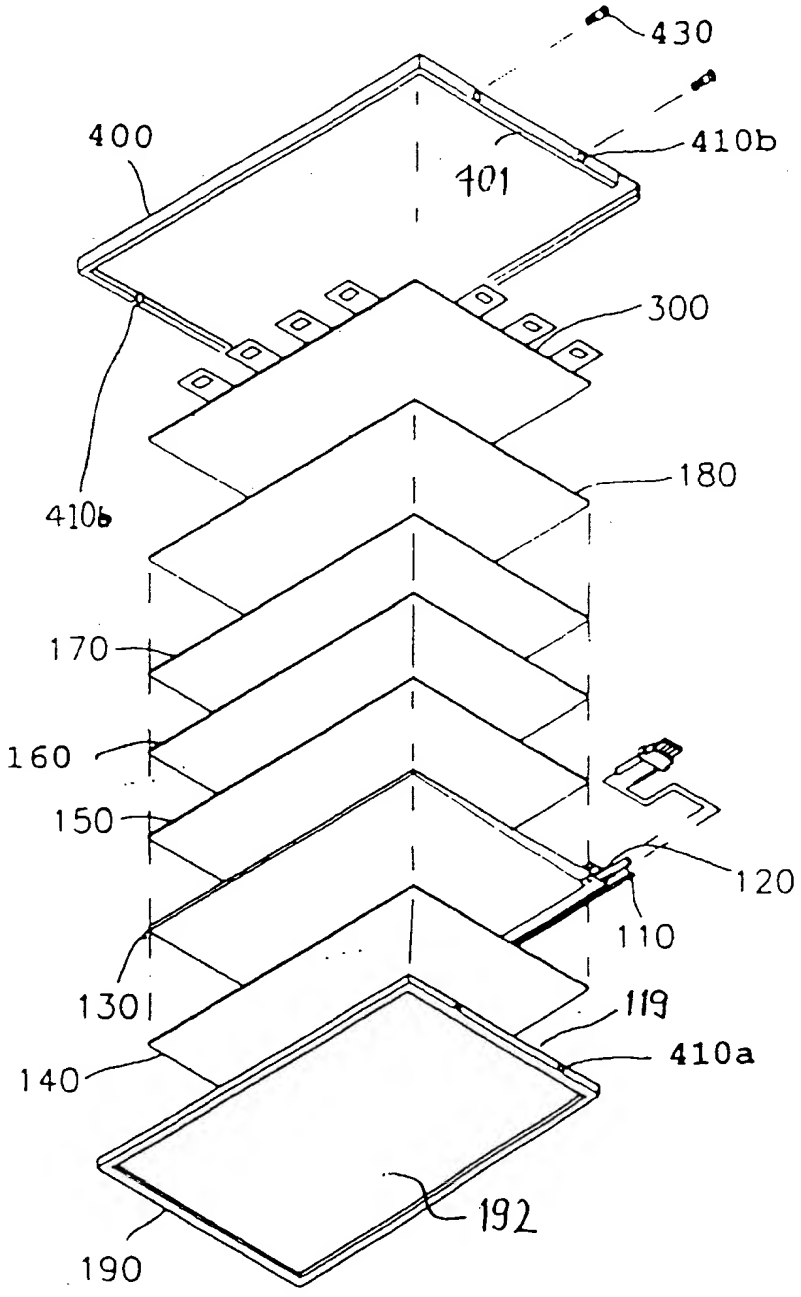

430
400
401
410b
300
410b
180
170
160
150
120
110
130
119
410a
140
192
190

FIG. 7

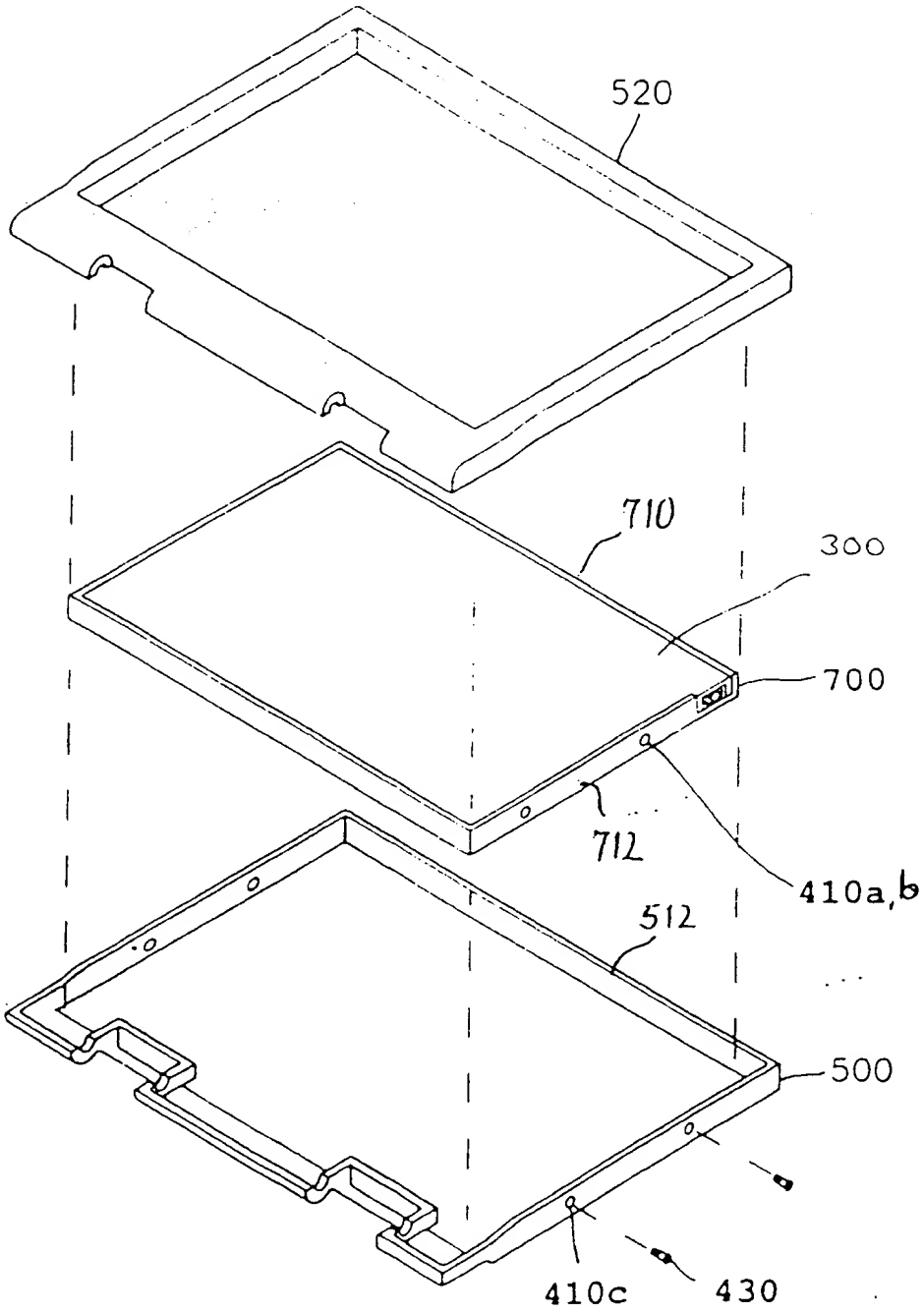


Fig. 8a

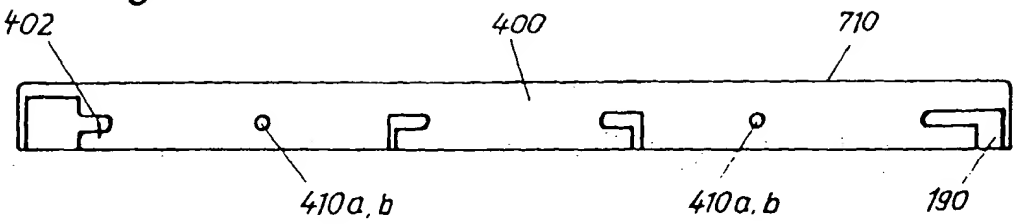


Fig. 8b

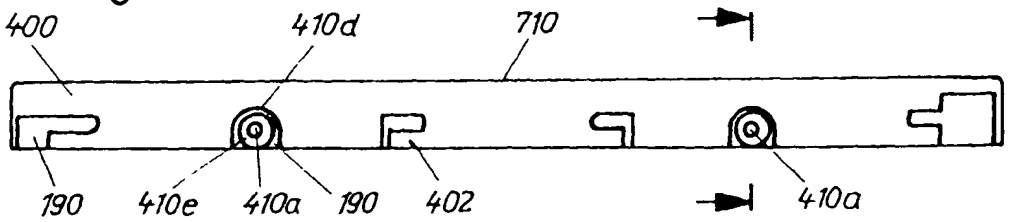


Fig. 8c

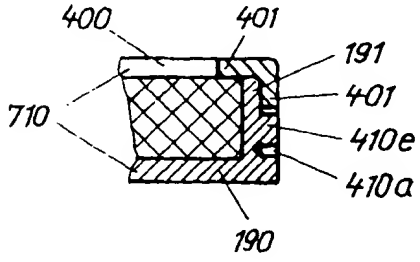
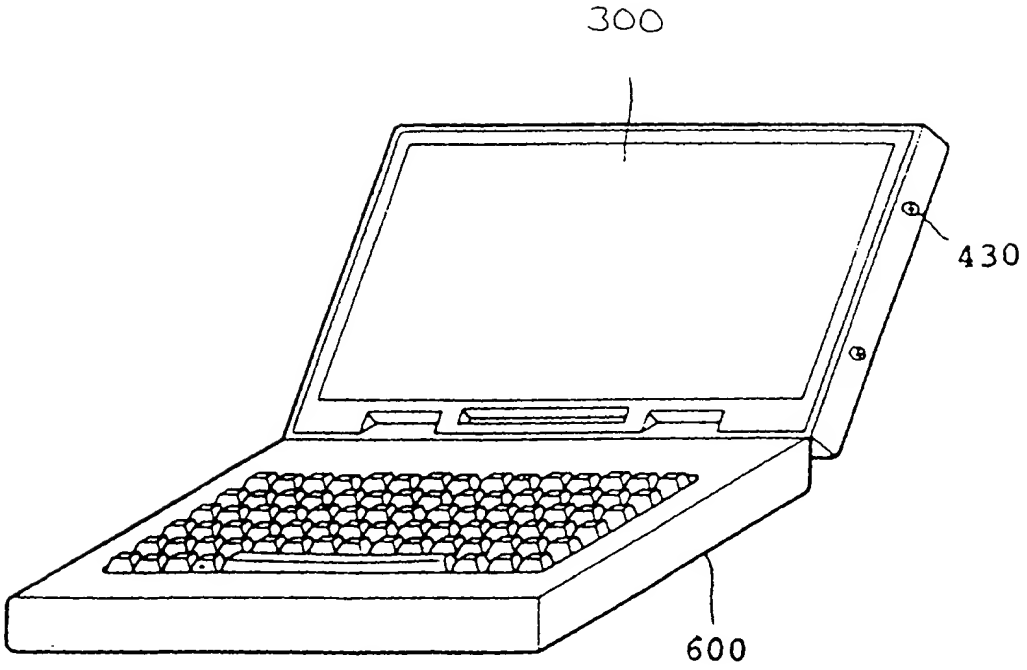


FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 6383

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 276 589 A (BARTLETT RICHARD A ET AL) 4 January 1994 * abstract; figures 1-11 *	1,8	G02F1/13 G06F1/16
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 416 (P-1584), 3 August 1993 & JP 05 080334 A (ROHM CO LTD), 2 April 1993, * abstract *	1,8	
A	"CELL SUPPORT ASSEMBLY WITHOUT SCREW" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 37, no. 12, 1 December 1994, page 33 XP000487692 * the whole document *	1,8	
A	EP 0 604 872 A (CITIZEN WATCH CO LTD) 6 July 1994 * page 4, line 43 - page 5, line 14; figure 1B *	1,10	
A	"STRUCTURE DESIGN FOR LIQUID CRYSTAL DISPLAY MODULE" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 39, no. 1, 1 January 1996, pages 71-73, XP000556325 * the whole document *	1,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
G02F
G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 July 1998	Ciarelli, N

CATEGORY OF CITED DOCUMENTS

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